appointments in the Civil Service. The application of scientific principles to engineering is the special feature of our age, and instruction in these principles, and practical training in their application, should be part of the training of every engineer; and this can only be acquired in a properly-equipped school. A want of familiarity with details will surely be remedied, but a want of scientific knowledge will be a lasting cause of danger to the public.

Yours very truly,

GEORGE FRANCIS FITZGERALD.

THE GAPE WORM OF FOWLS (SYNGAMUS TRACHEALIS).

IN the Bulletin of the Buffalo Society of Natural Sciences, vol. v. No. 2, 1886-7, is a paper by Dr. H. D. Walker, which does not appear to have been noticed in this country, on "The Gape Worm of Fowls (*Syngamus trachealis*)." The writer claims to have discovered that the common earthworm (*Lumbricus terrestris*) is the intermediate host of this well-known parasite, and to have observed it in all stages of its development. He further suggests the use of common salt on infected poultry runs to secure the extermination of these noxious pests by destroying the worms which harbour and distribute them.

The series of experiments by which he has arrived at his conclusions are interesting, and afford strong presumtive evidence of their correctness. The earthworms were carefully dissected and examined, the embryonic form of *Syngamus* being found in them, "differing but slightly in structure, so far as can be discovered from the embryo which has passed through one moult after the egg has hatched in water."

The question may be asked: Why should it differ at all if it is the same? It may be suggested that earthworms are themselves subject to various intestinal parasites and that the embryonic forms of many species and even genera are scarcely distinguishable from each other; but with a view to obtaining corroborative evidence Dr. Walker fed some chickens with worms obtained from a place where *Syngamus* had not been noticed. These chickens did not develop the gapes. An examination of worms from this spot showed them to be free from embryos such as were found in others. The double observation certainly points to the probability that in the first instance the embryo of *Syngamus* had been rightly recognized.

Embryos were also found in the œsophagus and in the lungs of birds to which earthworms taken from an infected locality, but carefully washed and cleansed externally, had been given.

The only link apparently wanting to complete the chain of evidence is to determine the manner in which the parasite (if it be truly the embryo of *Syngamus*) makes its way into the intestinal canal of the earthworm.

Dr. Walker concludes that it is taken in with its food. His evidence upon this point is chiefly negative. Eggs of *Syngamus* were placed on damp earth in a dish to which living earthworms were added a fortnight later. After ten days chickens were fed with these worms, but were not attacked. This experiment would have been more complete and perhaps conclusive if the worms had been supplied at the same time with vegetable food. Unless the worms were fed, the only means of entry for the embryos of the parasite must have been by boring through the outer integument of their bodies, which is not suggested.

Dr. Walker notices and examines somewhat critically a paper by Dr. Pierre Mégnin, published under the auspices of the Entomological Society of London in 1883, in which the author, after a minute inquiry into the history, habits, and development of *Syngamus trachealis*, came to the conclusion that the epidemic of gapes is spread, first by "food or drink which has become infested with eggs or embryos; secondly, (by) the diseased birds themselves, which are constantly disseminating the eggs of the parasite; and therefore all other living agents, perfect insects, larvæ, or mollusks (for example, the larvæ of ants, which are the habitual food of young pheasants, have been suspected, with some appearance of reason) may be acquitted of any share in spreading the disease." The American author disputes these conclusions. Admitting that the eggs will hatch in water, and that the embryos may be taken in by birds drinking infected water, he finds no instance, after repeated experiments, in which eggs swallowed by a bird have produced the disease, and although he thinks that exceptional cases might occur, he concludes that the instrumentality of the intermediate host is not ordinarily dispensed with. This is the only material point in which Walker differs from Mégnin, and there is nothing in Walker's discoveries to impair the accuracy of Mégnin's observations, so far as they go. Dr. Walker's observations on the structure and development of the parasite from the egg through its embryonic stages agree substantially in all other respects with those of Dr. Mégnin, except that he believes "the egg of *Syngamus* within the perfect worm just arrived at maturity does not contain a developed embryo," whereas Mégnin found "embryos quite perfect and living in eggs not yet freed from the decomposing bodies of female *Syngami* attached to the tracheal mucous of pheasants that had died of gapes."

The discovery of the distribution of these parasites through the instrumentality of earthworms, which are undoubtedly a favourite food of all young game birds, as well as of domestic fowls, is especially interesting to game preservers, and the theory is strongly supported by their experience.

First, if, as Dr. Mégnin believed, the eggs could be hatched only in water, a gamekeeper could have counted upon reducing to a minimum the risk to his artificially-reared birds by depriving them of water and feeding them upon food carefully moistened with pure spring water only, or more conveniently, upon water that had been first boiled. Many have followed this rule habitually and with good results, but certainly without securing any immunity from occasional outbreaks of the "gapes disease." Secondly, all who have had any experience in rearing pheasants or partridges, or have observed the growth and health of broods of the young of these birds in a wild state, must have noticed that very dry summers are much more favourable to the maturing of full broods and coveys than those in which a greater degree of moisture prevails, but if after very dry weather copious showers or very heavy dews moisten the surface of the ground when the birds have not yet attained their full growth, an outbreak of gapes is almost certain to follow, and is very rapid in its effects. So long as the ground is hard and dry earthworms do not come to the surface, but whenever it becomes sufficiently moistened to permit them to throw up their casts and to reach the surface, all species of birds of which they form a natural or favourite food are eager to seek and to devour them. The birds named by Dr. Walker as those in which *Syngamus* has been found are, with the single exception of the swift, all worm-eating birds. He does not mention on what authority the swift is included in the list, but it is difficult to understand, if water is to be regarded as the only medium of conveyance for this parasitic disease, why many other birds should not also have been found to be affected by it. We believe Dr. Walker's discovery has been received in America with some incredulity, but apart from the careful observations and experiments on which he relies, the accuracy of which there seems to be

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no good reason to dispute, the field experience of those who have had the best opportunities of forming an opinion on the subject would tend to support the probability that his conclusions are in the main correct.

WALSINGHAM.

NOTES.

MEN of science will be glad to learn that, at a meeting recently held at Dr. George Johnson's house, it was proposed to make Sir William Bowman some acknowledgment of the appreciation in which he is held on account of his high character, and professional and scientific attainments. A portrait of himself was suggested, and also, possibly, a reprint of some of his publications. Dr. George Johnson, Mr. J. W. Hulke, and Prof. Burdon Sanderson undertook to see Sir William Bowman, and ask his acceptance of the proposal. This consent having been received, a Provisional Committee was at once constituted, at whose invitation a number of eminent men of science formed themselves into the first list of the "Committee of the Bowman Testimonial Fund." As this body is already large and widely scattered, the practical carrying out of the scheme has been relegated to a Sub-Committee, consisting of the Treasurer (Dr. George Johnson), the Secretaries (Dr. W. A. Brailey and Dr. W. H. Jessop), Mr. Power, and Prof. Klein. It is not proposed to place any limit in either direction to the amounts of individual subscriptions, though the Committee are generally of opinion that large subscriptions will be found unnecessary, and that the compliment is a greater one when paid by a longer list of comparatively small subscriptions. They also hope that the funds will allow the distribution of a good reproduction of the portrait to subscribers of at least two guineas. Mr. Frank Holl, whose sudden death is deeply deplored by all who interest themselves in English art, had undertaken to paint the portrait.

IN the House of Commons on Tuesday Sir H. Roscoe asked the Chancellor of the Exchequer whether the astronomical instruments for the international photographic survey of the heavens, recommended by the Royal Societies of London and Edinburgh and the Board of Visitors of the Greenwich Observatory, the estimates for which had been forwarded from the Admiralty some months since to the Treasury, were yet ordered; and, if not, whether, in view of the fact that all the thirteen other sets of instruments were ordered by foreign and colonial Governments last year, and consequently the British Observatories would be placed at a serious disadvantage, Her Majesty's Government would be prepared to put the necessary amount on the Estimates in order to avoid further delay. To these questions the Chancellor of the Exchequer returned the following answer:—"The astronomical instruments required for the international photographic survey of the heavens have not yet been ordered, and the House will soon be asked to vote the necessary funds. It is, I believe, the case that thirteen instruments have been already ordered by different Powers and public bodies, but the hon. member is mistaken in supposing that all the Powers whose co-operation is contemplated have as yet ordered their instruments. On the contrary, two of the Great Powers, so far from ordering their instruments, have not yet definitely declared their intention to take part in the work. I do not think there is any cause to fear that Great Britain will be behindhand in the matter."

AMONG the Civil List pensions granted during the year ended June 20, 1888, were the following:—To the Rev. F. O. Morris, in recognition of his merits as a naturalist, £100; to Mr. William Kitchen Parker, F.R.S., in recognition of his services to science as an investigator, £100; to Mrs. Balfour Stewart, in recognition of the services rendered to science by her late husband, £50.

THE summer meeting of the Institution of Mechanical Engineers was opened at Dublin on Tuesday. In his Presidential address, Mr. Carbutt did not confine his remarks to purely mechanical subjects, but drew the attention of the members to some statistics relating to the population of Ireland and to Irish agriculture and industries. Mr. Carbutt expressed a decided opinion to the effect that more money should be spent in Ireland on education, and especially on technical education. "What I mean by technical training," he said, "is teaching children to use their hands and eyes, and also giving them such practical acquaintance with the applied sciences as may bear upon the industrial employments in their district. I hope the valuable speech on the need of technical education, made by the Marquess of Hartington at our annual dinner in May, will be widely read. I may refer to the work done in the agricultural school at Glasnevin, three miles out of Dublin, of which Mr. Carrol is the head. To this school is attached a farm of 180 acres for teaching practical farming. The Munster dairy school, started in 1880 with a farm of 126 acres, is quite full, and frequently has to refuse pupils. The Government grant to these two schools is £2671. The Baltimore industrial school, the Public Works Commissioners state, will practically be a technical school of fishing. The Belfast technical school is very successful in training pupils in flax cultivation and spinning. Dairy schools have been established twenty years in Denmark, Sweden, Germany, and Normandy. Let me give an example of what the result has been in Denmark. A Report on agricultural dairy schools has been lately presented to Parliament from a Departmental Commission presided over by Sir R. H. Paget, M.P., which states that in 1860 the British Vice-Consul at Copenhagen reported that the butter made in that country was execrably bad. What has happened? Denmark has now ten State-aided dairy schools, with the result that her exports of butter to the United Kingdom have increased as follows:—

1867	80,000 cwts.,	value £422,479
1877	210,322 ,,	,, 1,347,791
1887	487,603 ,,	,, 2,669,123

In France theoretical and practical lessons in agriculture are now given every week in the primary schools; and a circular has been issued inviting the municipalities to provide for every district a demonstration plot of not less than half an acre for the purpose of applying the principles taught in the school."

TWO rather striking speeches on education were delivered at the Sorbonne on Monday at the distribution of prizes to the successful students of the great secondary schools of Paris. M. Blanchet, Professor of History at the Lycée Charlemagne, while expressing a high opinion of the value of the ancient classics in education, urged that methods of instruction should be adapted to the actual wants of the present day. He quoted the following passage written by Fleury at the end of the seventeenth century: "It seems to me that we ought to accommodate our studies to the present state of our manners, and to study those things which are of use in the world, as we cannot change this use so as to accommodate it to the order of our studies." "Truly," said M. Blanchet, "these old pedagogues were great revolutionists. What is new in the history of French pedagogism is not the spirit of innovation and progress but that of routine." M. Lockroy, the Minister of Public Instruction, spoke in a similar tone. It was essential, M. Lockroy pointed out, that Frenchmen should know what was said and written beyond their frontiers. Science was progressing everywhere, and they should be able to follow its progress abroad, especially in Germany and England. That was one reason why the modern languages had such a strong claim on the young of this generation. M. Lockroy protested against the notion that anyone thought of destroying Greek and Latin studies. But these studies were not the only solution of the very complicated problem of modern educa-

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